2006 King County Flood Hazard Management Plan Recap

Presentation to Metropolitan King County Council
Committee of the Whole
January 16, 2007

Presentation Overview

- Background – *Pam Bissonnette*, Director, KC DNRP
- Flood Plan Overview – *Mark Isaacson*, Director, WRLD
- Levee Certification Issues – *Pam Bissonnette*
- Climate Impacts on Flooding – *Dr. Richard Palmer, PhD, PE*
- Conclusion and Next Steps – *Pam Bissonnette*

History and Current Status

- Last Plan Adopted in 1993
  - Insufficient Funding
- Current funding: $3.5 million per year
- Current need: $15-30 million per year
- 2006 Plan recommends Flood Control Zone District for funding and project implementation
- Adoption of 2006 Plan will result in additional **flood insurance discounts**.
- Adoption of 2006 Plan will **increase eligibility for federal funding**.

Lessons From Hurricane Katrina

- Independent expert review of reasons for catastrophic New Orleans Levee Failures
  - U.C. Berkley
  - National Science Foundation
- New Orleans levees that failed were certified
- Factors of safety were inappropriately low for a system that protected a major metropolitan area
- Designs should have incorporated the latest technical advances in flood protection and been reviewed by independent experts
- State and local governments should have provided a second check and opinion

Lessons From Hurricane Katrina

- Safety was “traded for mediocrity, lower expenditures, and getting along”
- Deficiencies in “maintenance of a deliberate culture of diligence in seeking overall system reliability”

Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005

Flood Plan Heeds Lessons of Katrina

- Local independent review of facility design – including by national experts
- Ensuring designs incorporate latest technical advances in flood protection
- Adaptive management to update approaches based on new information
- Factors of safety appropriate for protecting a major metropolitan area
- Proposing adequate funding

Flooding is a Regional Hazard

- Since 1990, King County has been declared a federal disaster area eight times
- Major damage to flood protection facilities from Nov. ’06 storm - repair estimate is $25M to $38M
- Flooding occurs on all six major rivers in King County: South Fork Skykomish, Snoqualmie, Sammamish, Cedar, Green, and White Rivers
- Warmer winters are predicted to exacerbate flooding in the future

Flooding is a Regional Hazard

- $7+ Billion Total AV Protected
- $.5M - $160M Total AV per property
- FEMA mapped floodplain

November ’06 Flood Disaster

Mt. Si High School – City of Snoqualmie

November ’06 Flood Disaster

Kimball Creek

November ’06 Flood Disaster

Snoqualmie Basin Flooding

November ’06 Flood Disaster

Upper Preston Road Failure - Raging River

November ’06 Flood Disaster

Upper Preston Road Repair – Raging River

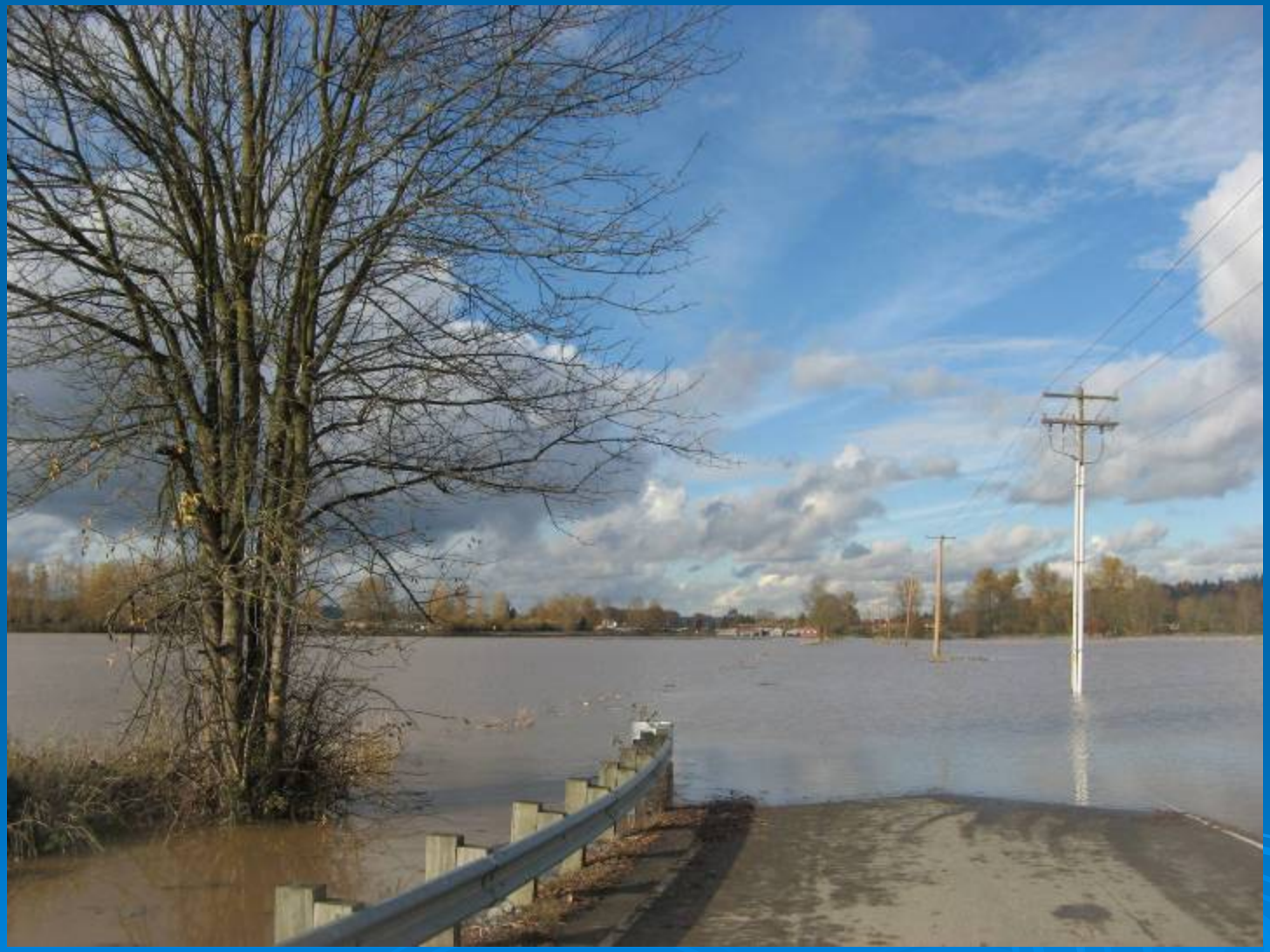
November ’06 Flood Disaster

Shamrock Park – South Fork Snoqualmie

November ’06 Flood Disaster

South 104th Street Emergency Road Repair – Lower Green River

November ’06 Flood Disaster



86th Ave South – Lower Green River

November ’06 Flood Disaster

Raging River

November ’06 Flood Disaster

Upper Preston Road failure - Raging River

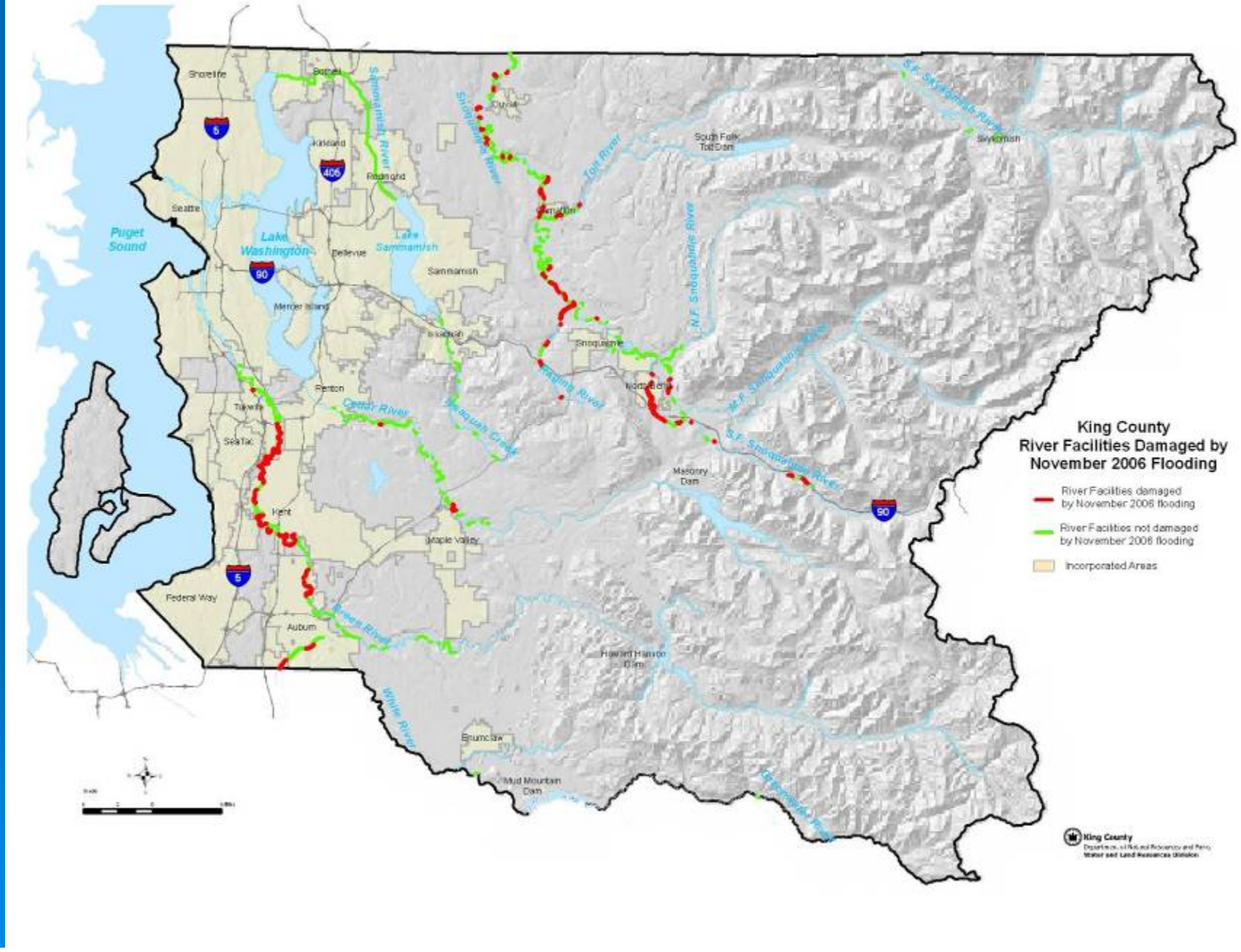
November ’06 Flood Disaster

- 78 damaged facilities
- Cracking, slumping, failures, and erosion
- Record rainfall in ‘06 revealed many levee deficiencies

Slope erosion and slumping failure - Lower Green River

Levee cracking - Lower Green River

78 County Flood Facilities Damaged by Nov. 2006 Flooding



2006 King County Flood Hazard Management Plan

Capital Improvement Projects

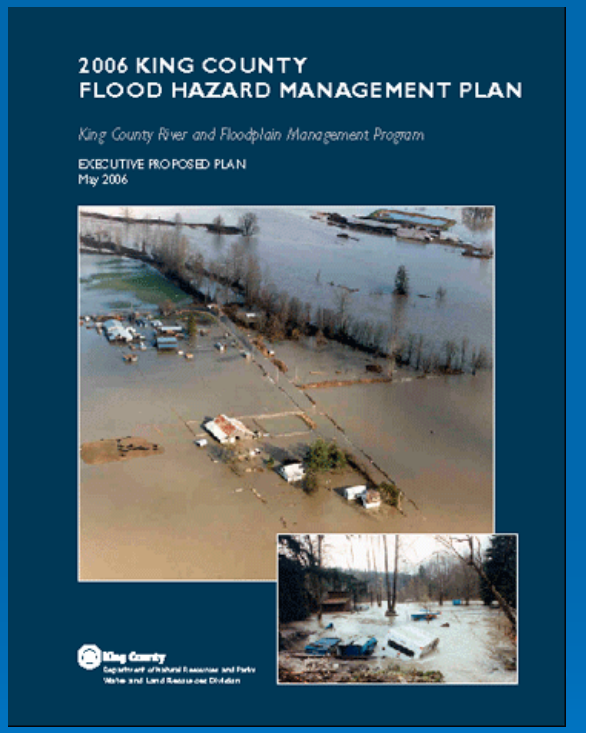
- Levee and revetment repair and replacement
- Home elevations
- Acquisition of repetitive loss properties

Floodplain Management Programs

- Regional Flood Warning Center and emergency response
- Public education and outreach
- Mapping and technical studies
- Citizen inquiries and public response
- Partnerships with state and federal agencies

Plan Implementation

- $179M to $335M



Criteria for Project Selection

- Flood Plan projects on main stems of rivers
- Projects selected based upon:
  - Consequences – public safety/property loss
  - Urgency
  - Contractual Requirements
  - Funding and partnerships
- Annual legislative approval of final project lists
- Other projects may meet criteria

Levee Certification Issues

- Certification:
  - Flood plain property is treated as not being in the flood plain for purposes of development regulations and insurance
- Tukwila 205 Levee is only currently certified levee in King County.
- Certification currently under reevaluation
  - Exception to freeboard requirements was made at the time of last certification.
- Reconstruction needed regardless of evaluation
  - National experts: levee fails to meet minimum federal factors of safety.
  - Problems with slope angles, original construction materials causing seepage, piping, cracks, and slides.
  - Segale Levee repairs over 10 years: 10% of total spending for 2.5% of total facilities
- Flood Plan project to achieve federal factors of safety.

Potential Consequences
Tukwila 205 Levee Failure/Decertification

Process for Completing Segale Levee Project

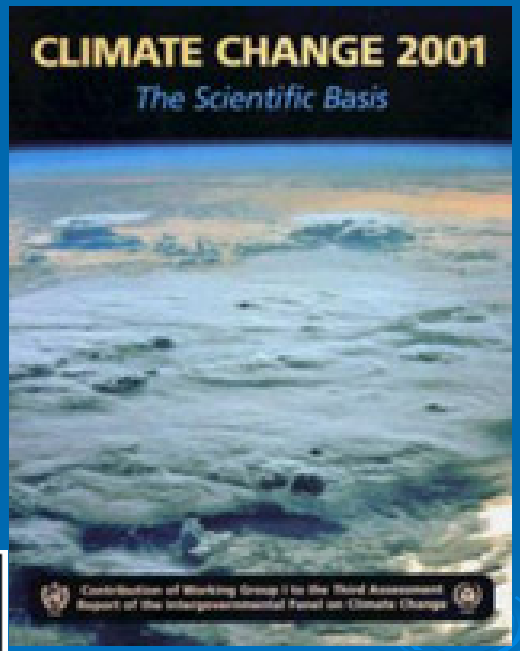
Impacts of Climate Change on Flooding

Presented by:

Richard Palmer
Department of Civil and Environmental Engineering
Principal, Climate Impact Group
University of Washington
Seattle, WA 98105
www.tag.washington.edu
January 2007

Climate Change

- Climate change impacts on water resources are recognized as extremely important.
- It is useful for the region to get a clear statement of the present status of science
- Desire to be science-based (Peer reviewed, scientific/engineering literature, and IPCC reports)



2500+ scientific expert reviewers
800+ contributing authors and
450+ lead authors from
130+ countries
6 years work
4 volumes
1 Report

Paris, 2 February 07

The first volume will be released.

- What progress has been made in understanding and attributing climate change?
- What do observations of the atmosphere, oceans, sea level, snow and ice tell us?
- How has climate been behaving in the last hundreds of thousands years?
- Which are the projections of future changes?

Find the latest information on "The Physical Science Basis of Climate Change" in Working Group I report

Building Blocks Document

(Source: http://agexted.cas.psu.edu/FCS/mk/images/BuildingBlocks.jpg)

- Document identifies the changes that are occurring
- As with other science, our understanding will improve with time
- Uncertainties exist, but much in known
- A principal concern identified was increased flooding due to climate change

Building Blocks

4. **Global precipitation is projected to increase in the future, although there is less certainty in predicting changes in precipitation than in temperature.**

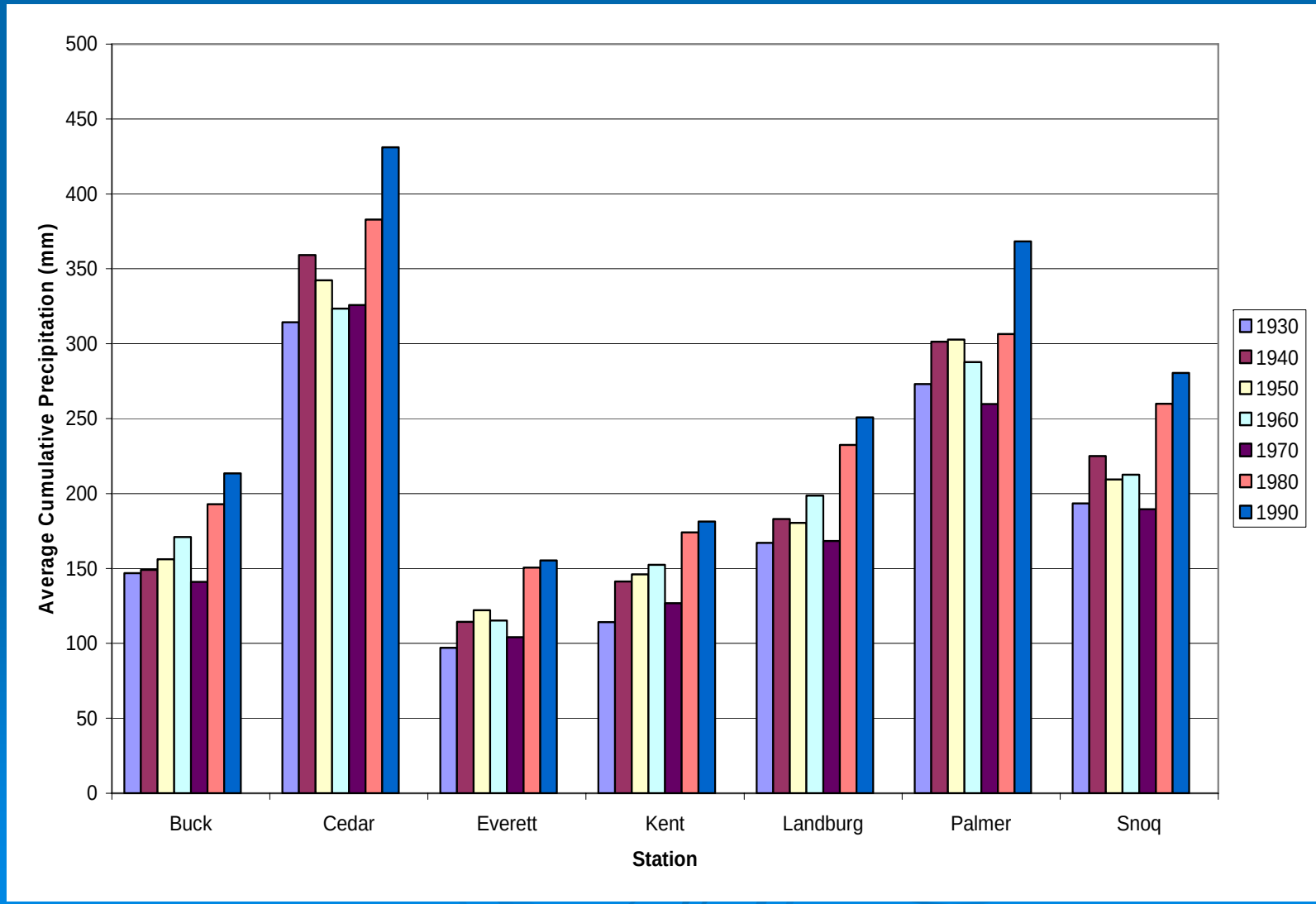
5. **The occurrence of heavy precipitation events has increased over the U.S. during the 20th century. This trend is projected to continue during the 21st century.**

9. **Climate change is projected to increase the frequency of flood events in most western Washington river basins.**

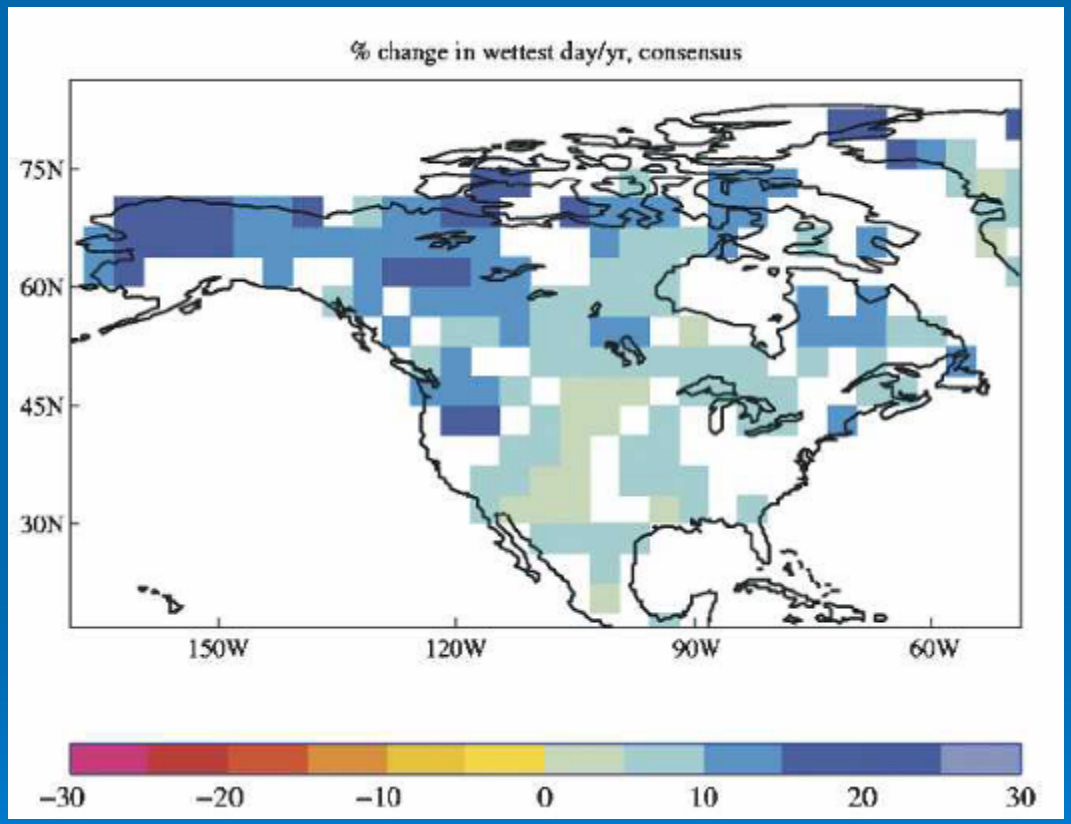
Historic Trend Evaluation of Daily Precipitation

- Preliminary Results suggest:
  - Most significant trend is in November
  - Larger percentage of annual rainfall occurring in November, total annual precipitation has remained relatively constant
  - Difficult to identify an increase in extreme events to date, models do forecast an increase.

Decadal Trends in November Monthly Precipitation



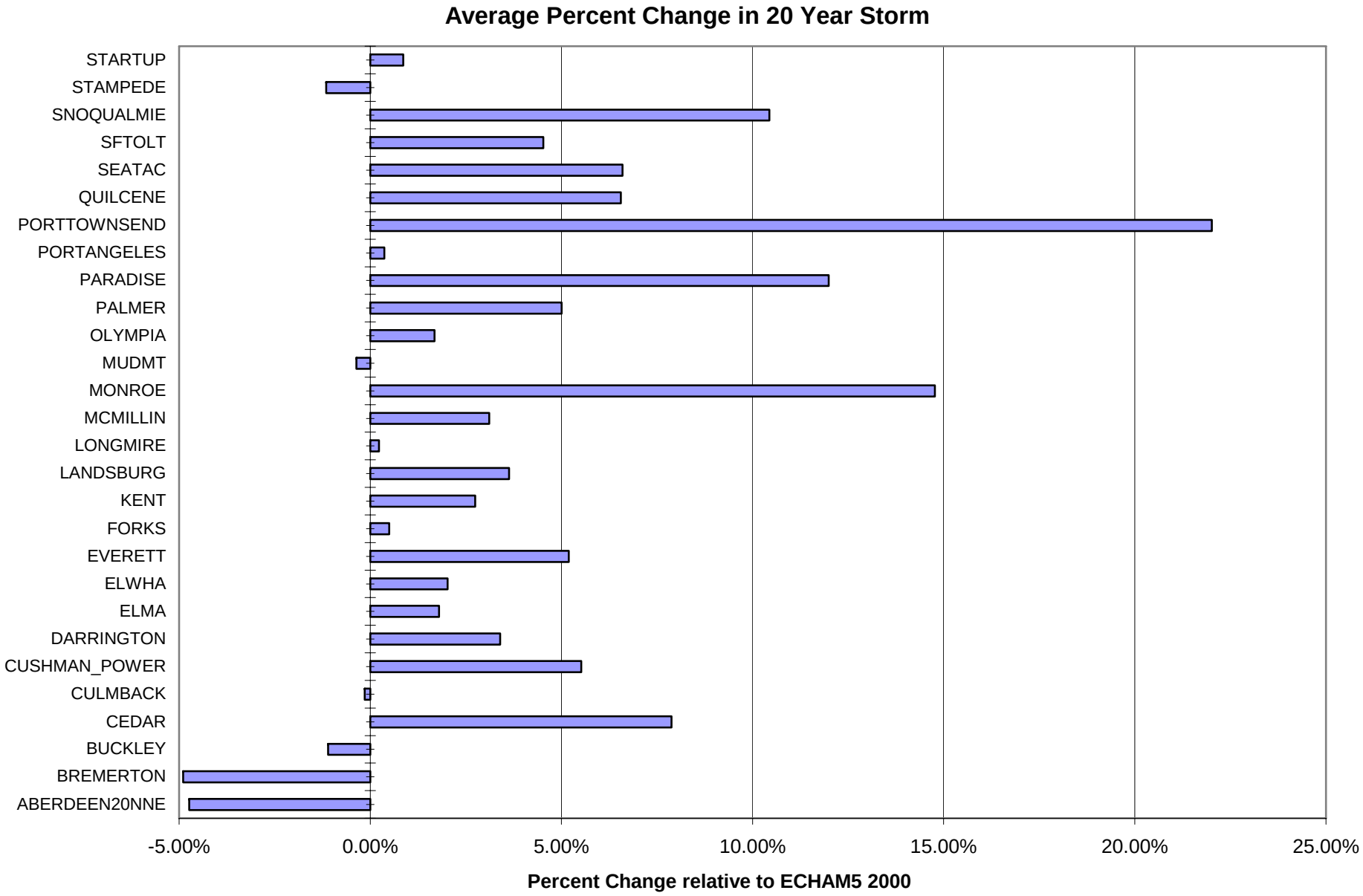
Extreme Events



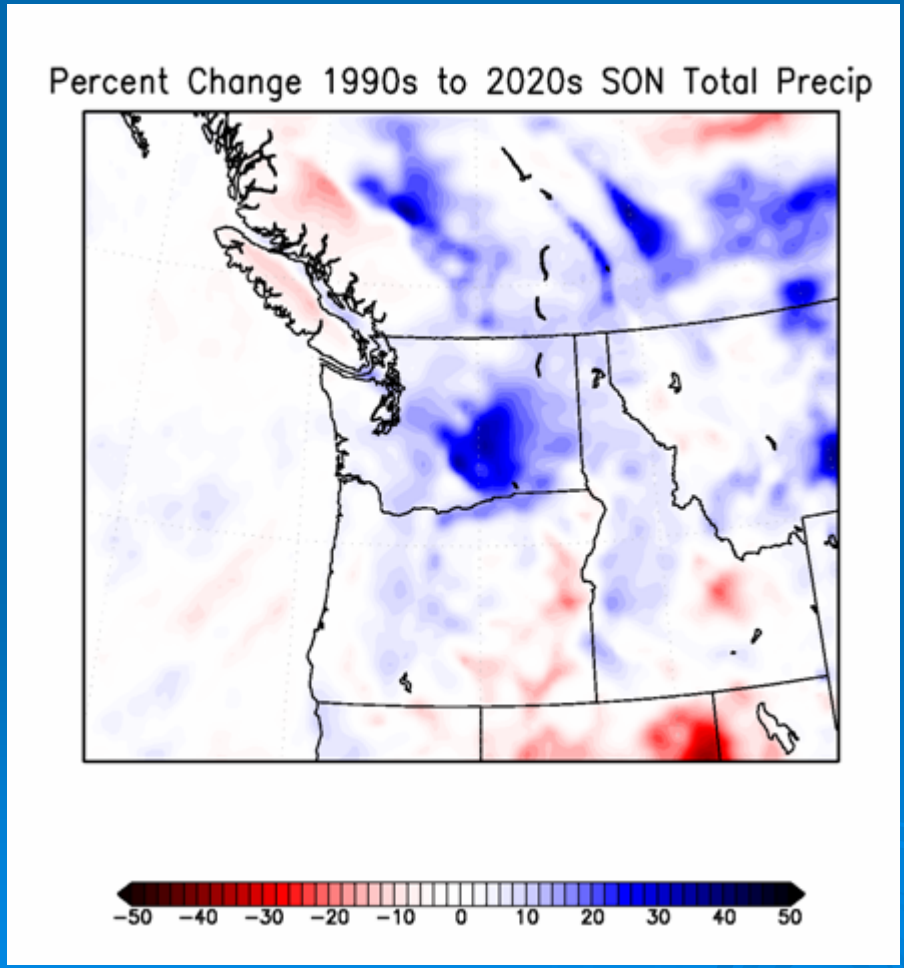
- Global models suggest a 5-15% increase in extreme precipitation events

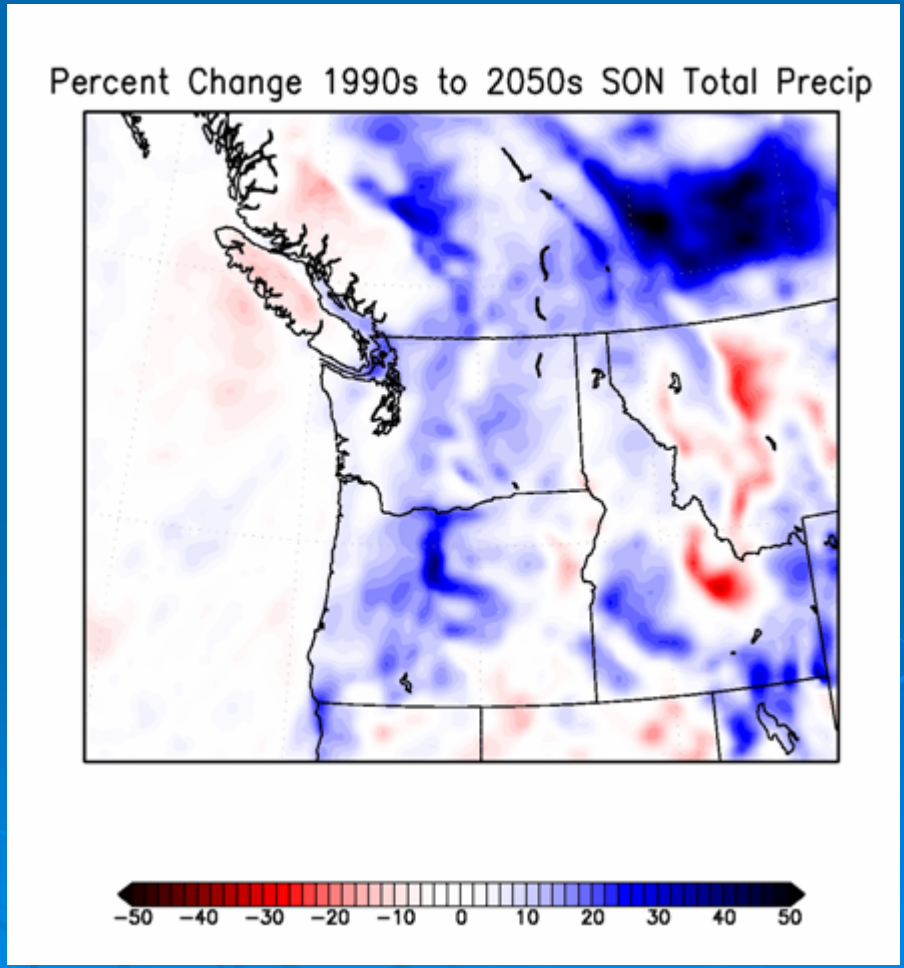
(Typically occur November)

Taken from: Groisman et al, 2005. Trends in Intense Precipitation in the Climate Record. *Journal of Climate*, Vol. 18, May 2005, 1326-1350


Average Percent Change in 20 Year Storm
STARTUP
STAMPEDE
SNOQUALMIE
SFTOLT
SEATAC
QUILCENE
PORTTOWNSEND
PORTANGELES
PARADISE
PALMER
OLYMPIA
MUDMT
MONROE
MCMILLIN
LONGMIRE
LANDSBURG
KENT
FORKS
EVERETT
ELWHA
ELMA
DARRINGTON
CUSHMAN_POWER
CULMBACK
CEDAR
BUCKLEY
BREMERTON
ABERDEEN20NNE
-5.00%
0.00%
5.00%
10.00%
15.00%
20.00%
25.00%
Percent Change relative to ECHAM5 2000

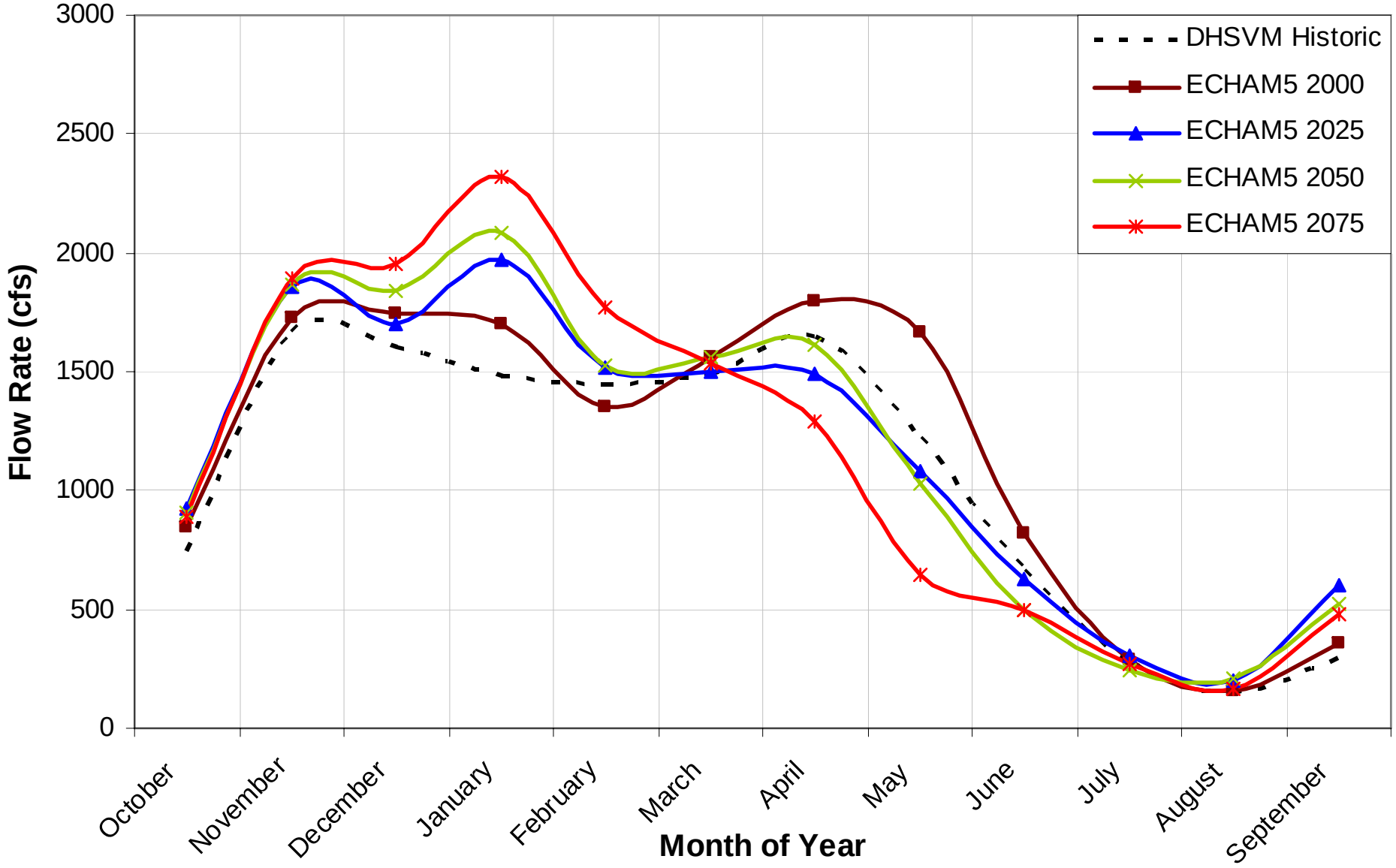
MM5 Climate Projections – Percent Change in Precipitation





Monthly Streamflows Forecasted w/ ECHAM5

Howard Hanson Inflow



Climate Change Impacts on Flooding

- All indications that climate change will result in more extreme flood conditions
  - Increase intensity in hydrologic cycle
  - Recent decades show increase in monthly precipitation in November
  - Global and local models emphasize this trend will continue

Timeline and Next Steps

Date	Action
Jan. 16, 2007	Flood Plan public hearing
Jan. – Feb. 2007	Council action on Flood Plan
Jan. – Mar. 2007	Flood Control Zone District Formation Ordinance in committee
March 1 – May 7 2007	Council action on FCZD Formation Ordinance
May – Oct. 2007	FCZD Advisory Board appointments and meetings
Nov. 19, 2007	Action on FCZD CIP and funding (by Board of Supervisors/County Council)
Jan. 1, 2008	Implementation of flood protection through District begins

“We live in a region with the potential of natural disasters that can be exacerbated by inadequate infrastructure. It makes sense to invest in safeguards now instead of paying for widespread destruction later. New Orleans taught us that.”

-- Seattle Times Editorial Board, July 10, 2006

“[This] investment would amount to as much as $335 million in repairs over the next 10 years, funded by a property tax increase of as much as $30 a year on a $300,000 home. It would seem to be the cheapest insurance a homeowner could buy.”

-- Seattle Post Intelligencer Editorial Board, July 10, 2006